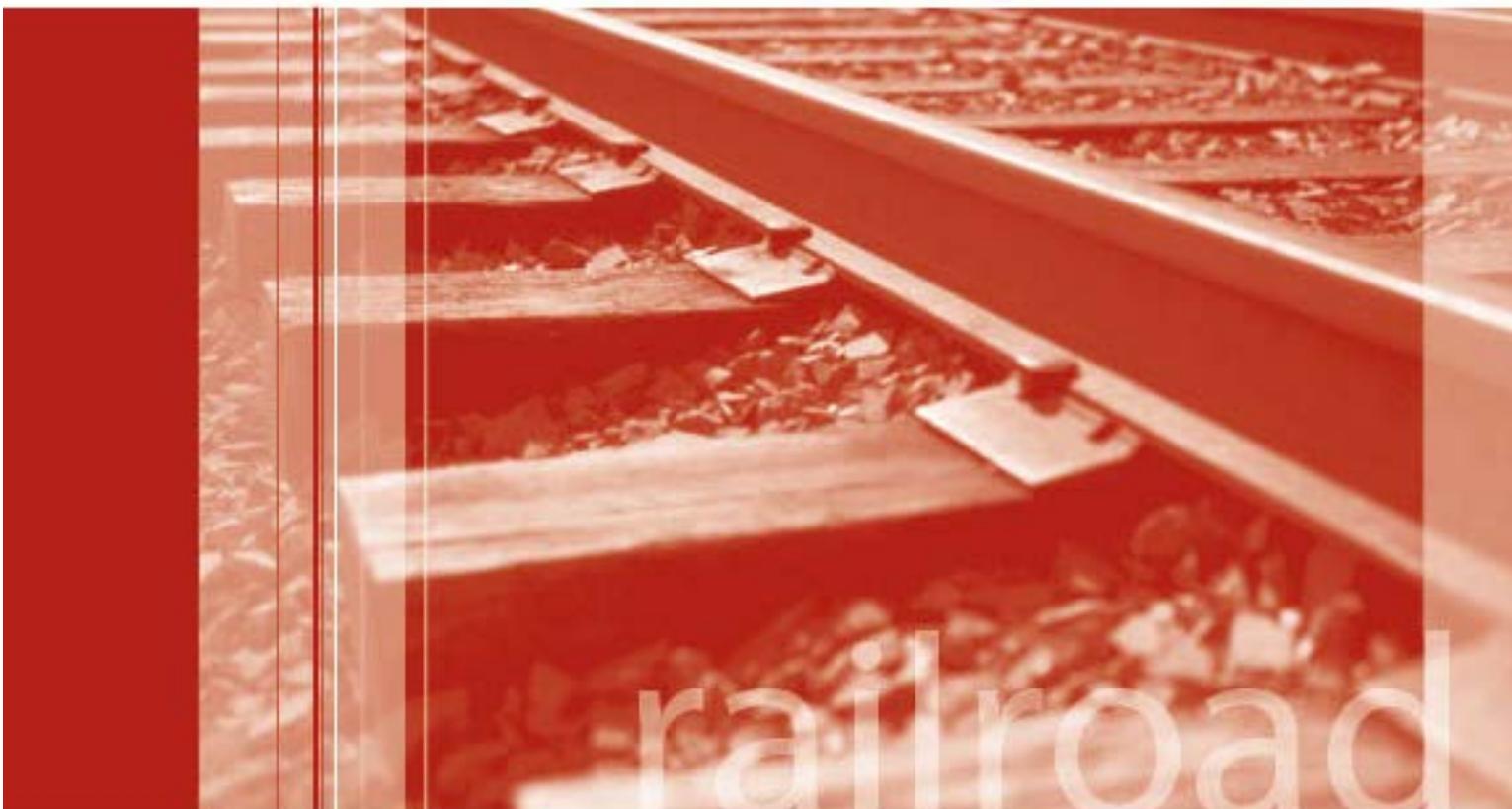


Long Island Rail Road Roadway Worker Fatality
Queens Village, New York
June 10, 2017



Accident Report

NTSB/RAR-20/01
PB2020-101003



National
Transportation
Safety Board

NTSB/RAR-20/01
PB2020-101003
Notation 64654
Adopted April 29, 2020

Railroad Accident Report

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National
Transportation
Safety Board

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Washington, D.C. 20594

National Transportation Safety Board. 2020. *Long Island Rail Road Roadway Worker Fatality, Queens Village, New York, June 10, 2017*. Publication Type NTSB/RAR-20/01. Washington, DC: NTSB

Abstract: On June 10, 2017, at 10:12 a.m. eastern daylight time, Long Island Rail Road (LIRR) train 7623 on track 3 approached a five-member crew of roadway workers at the Queens Interlocking in Queens Village, New York. The foreman and three roadway workers were inspecting and making minor repairs to track 1 within the Queens Interlocking. A fifth roadway worker was clear of the tracks keeping pace with the work group. Upon seeing train 7623, the watchman/lookout sounded a handheld horn, yelled at the other workmen, and raised a paddle that told the locomotive engineer to sound the train's horn. The locomotive engineer sounded the train's horn. Three of the roadway workers remained in track 1, but the foreman stepped into the path of the train on track 3 and was killed. The train was traveling about 78 mph when the locomotive engineer applied the emergency brakes just before impact. The National Transportation Safety Board (NTSB) identified the following safety issues: roadway worker protection, roadway worker on-track safety briefings, management oversight, Federal Railroad Administration (FRA) oversight, and worker fatigue. As a result of this investigation, the NTSB makes safety recommendations to FRA, Metropolitan Transportation Authority (the parent of LIRR), and the International Association of Sheet Metal, Air, Rail and Transportation Workers.

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Abbreviations and Acronyms

CFR	<i>Code of Federal Regulations</i>
EMU	electric multiple unit
FAMES	Fatality Analysis of Maintenance of Way Employees and Signalmen
FAST	Fatigue Avoidance Scheduling Tool
FRA	Federal Railroad Administration
LIRR	Long Island Rail Road
MOW	maintenance-of-way
MTA	Metropolitan Transportation Authority
NTSB	National Transportation Safety Board
PPOS	predetermined place of safety
PTC	positive train control
RWP	roadway worker protection
SAFER	Situational Awareness for Efficient Railroading
SMART	International Association of Sheet Metal, Air, Rail, and Transportation Workers
TAW	train approach warning

Executive Summary

On June 10, 2017, at 10:12 a.m. eastern daylight time, Long Island Rail Road train 7623 on track 3 approached a five-member crew of roadway workers at the interlocking in Queens Village, New York.¹ The foreman and three roadway workers were inspecting and making minor repairs to track 1 within the Queens Interlocking. A fifth roadway worker was clear of the tracks, keeping pace with the work group. Upon seeing train 7623, the watchman/lookout sounded a handheld horn, yelled at the other workmen, and raised a disc that told the locomotive engineer to sound the train's horn. The locomotive engineer then sounded the train's horn. Three of the roadway workers remained in track 1, but the foreman stepped into the path of the train on track 3 and was killed. The train was traveling about 78 mph when the locomotive engineer applied the emergency brakes just before impact.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was Long Island Rail Road's decision to use train approach warning to protect the roadway workers on active tracks. Contributing to the accident was Long Island Rail Road's and the International Association of Sheet Metal, Air, Rail and Transportation Workers' allowance of overtime work schedules without properly considering and mitigating workers' risk of fatigue.

Safety Issues

- **Roadway Worker Protection.** Train approach warning fails to ensure adequate protection for roadway workers. The use of train approach warning increases the risk of accidents, particularly when there are multiple tracks and poor areas for the roadway workers to clear the track. Further, deciding to inspect and foul the tracks when it is known there will be increased train traffic was an unsafe management decision.
- **Roadway Worker On-track Safety Briefings.** The on-track safety briefing held prior to the accident was incomplete, and critical information, such as the predetermined place of safety to be used upon receiving warning of approaching trains, was not discussed.
- **Management Oversight.** Investigators determined that as currently implemented, the Long Island Rail Road Situational Awareness for Efficient Railroading operational testing program was not identifying known areas of noncompliance with Long Island Rail Road rules and Federal Railroad Administration regulations.

¹ For more information, see the factual information and analysis sections of this report. Additional information about the accident investigation can be found in the public docket for this accident (NTSB case number DCA17FR009) by accessing the Accident Dockets link for the Docket Management System at www.nts.gov. For more information on our safety recommendations, see the Safety Recommendation Database at www.nts.gov.

- **Federal Railroad Administration Oversight.** Investigators found that the Federal Railroad Administration's prior inspections did not find the reoccurring noncompliance failures discovered in this accident investigation.
- **Worker Fatigue.** The watchman/lookout and foreman had consecutive overtime shifts that disrupted their opportunities for restorative sleep during the 48 hours prior to the accident. Long Island Rail Road and its roadway worker labor union allowed overtime shifts without considering fatigue or its mitigation.

Findings

- None of the following were factors in this accident: (1) the mechanical condition of the train to include the train's braking system, (2) cell phone use by the employees, and (3) the use of alcohol or other tested drugs by the employees.
- The foreman failed to recognize that using train approach warning protection to occupy the tracks at the Queens Village Interlocking created an unacceptable risk.
- The on-track safety briefing held prior to the accident was incomplete because critical information such as the predetermined place of safety to be used upon receiving warning of approaching trains was not discussed, exposing the work crew to a greater risk of being struck by a train.
- Because violations of roadway worker protection rules, such as clearing to a safe place in an active track, appeared routine and were not consistently recorded by supervisors, the oversight by Long Island Rail Road, using the Situational Awareness for Efficient Railroading program, was ineffective in ensuring compliance with roadway worker protection rules and regulations.
- Long Island Rail Road management did not properly assess the hazards and mitigate the risks the roadway workers were exposed to while performing their work at Queens Village when using train approach warning.
- The Federal Railroad Administration's inspection program was ineffective in finding Long Island Rail Road's noncompliance with roadway worker protection regulations.
- Train approach warning regulations do not ensure protection for roadway workers to inspect and work on tracks where trains are allowed to continue to operate.
- The watchman/lookout and the foreman were likely fatigued because their overtime shifts did not allow for adequate periods of restorative sleep during the 2 nights before the accident.

- Had Long Island Rail Road used biomathematical models of fatigue avoidance to guide its development and approval of work schedules for roadway workers, the likely fatigue of the foreman and watchman/lookout would have been avoided and their overtime work requests for the day of the accident would have been denied.
- The Long Island Rail Road and the International Association of Sheet Metal, Air, Rail and Transportation Workers allowed workers to schedule overtime hours without consideration of fatigue, which exposed employees and the public to unnecessary risk.
- Without a Federal Railroad Administration requirement of hours of service regulations, roadway workers are at risk for fatigue-related accidents involving movements of trains.
- Roadway workers are at risk from fatigue-related accidents when management-labor contracts do not include work hour limits that address the risk of fatigue.

Recommendations

New Recommendations

To the Federal Railroad Administration:

- Revise your oversight inspection process to focus on roadway worker activities, especially when roadway workers are using train approach warning for protection. (R-20-5)
- Define when the risks associated with using train approach warning are unacceptable and revise Title 49 *Code of Federal Regulations* 214.329 to prohibit the use of train approach warning when the defined risks are unacceptable. (R-20-6)
- Promulgate scientifically based hours of service requirements for roadway workers. (R-20-7)

To the Metropolitan Transportation Authority:

- Identify the risks associated with using train approach warning as a method of on-track protection and require mitigations of the risks and prohibition of its use if effective mitigations are not possible. (R-20-8)
- Work with the International Association of Sheet Metal, Air, Rail and Transportation Workers to develop and implement a work scheduling program for roadway workers using a validated biomathematical model of fatigue avoidance to ensure that roadway workers at risk of being fatigued are not eligible for overtime. (R-20-9)

To the International Association of Sheet Metal, Air, Rail and Transportation Workers:

- Work with Metropolitan Transportation Authority management to develop and implement a work scheduling program for roadway workers using a validated biomathematical model of fatigue avoidance to ensure that roadway workers at risk of being fatigued are not eligible for overtime. (R-20-10)

Previous Recommendations**To the Metropolitan Transportation Authority:**R-18-6

- Audit Long Island Rail Road's use of train approach warning as a method of worker protection for compliance with Long Island Rail Road rules and federal regulations.

This recommendation was previously classified "Closed—Acceptable Action" on November 8, 2019.

R-18-7

- Following the completion of the audit, implement actions to correct any identified deficiencies.

This recommendation was previously classified "Closed—Acceptable Action" on November 8, 2019.

1. Factual Information

1.1 Synopsis

On June 10, 2017, at 10:12 a.m. eastern daylight time, Long Island Rail Road (LIRR) train 7623 on track 3 approached a five-member crew of roadway workers at the Queens Interlocking in Queens Village, New York.² The foreman and three roadway workers were inspecting and making minor repairs to track 1 within the Queens Interlocking. A fifth roadway worker was clear of the tracks, keeping pace with the work group. Upon seeing train 7623, the watchman/lookout sounded a handheld horn, yelled at the other workmen, and raised a disc that told the locomotive engineer to sound the train's horn.³ The locomotive engineer then sounded the train's horn. Three of the roadway workers remained in track 1, but the foreman stepped into the path of the train on track 3 and was killed. The train was traveling about 78 mph when the locomotive engineer applied the emergency brakes just before impact. Figure 1 shows the accident location.

1.2 Accident Narrative

The day of the accident, June 10, 2017, was the day of the Belmont Stakes horserace. LIRR added extra trains and routed some of them directly to the racetrack. The track leading to the Belmont Yard (and racetrack) was just north of the Queens Interlocking and was controlled by the Queens Interlocking tower block operator. Normally, there would have been five scheduled eastbound trains and seven westbound trains. On the day of the accident, there were two additional eastbound trains and one additional westbound train. To ensure there were no interruptions to the service, the LIRR assigned roadway workers to inspect and be readily available within the Queens Interlocking to attend to any unexpected track issues.

² (a) All times in this report are eastern daylight time. (b) LIRR is a subsidiary of the Metropolitan Transportation Authority (MTA).

³ LIRR uses the term *disc* to refer to the paddle-shaped banner the watchman/lookout uses to warn the work crew of oncoming trains.



Figure 1. Photo of the accident scene facing east. The site of the accident is marked with a red circle.

There were four main tracks within the Queens Interlocking. The tracks ran east and west. Starting from the north to the south the tracks were numbered 3, 1, 2, and 4. The outside tracks serviced the Queens Village Station platforms (outside tracks 3 and 4) just west of the Queens Interlocking. Trains were authorized to operate at 80 mph on all four tracks at the Queens Interlocking. Figure 2 shows the location of the roadway workers in the Queens Village track. The fifth roadway worker was not in the track and, therefore, is not shown in the graphic.

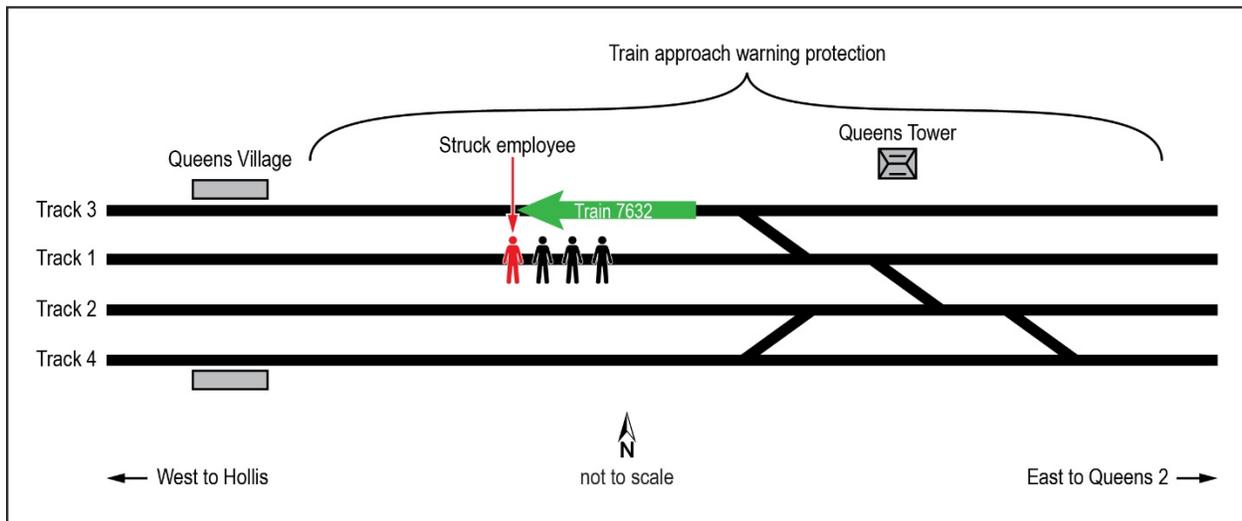


Figure 2. Queens Village track diagram.

On the day of the accident, the foreman and four roadway workers went on duty at the Queens Freight Yard at 7:00 a.m. As mentioned earlier, the LIRR wanted the crew available to ensure that the Belmont Stakes train service was not interrupted by a track issue. About 9:00 a.m., the foreman received instructions from the assistant supervisor of track that the crew needed to conduct a walking inspection of the main tracks within Queens Interlocking on the LIRR Main Line Branch. Specifically, they were to focus their inspections on insulated rail joints in the interlocking.⁴

The foreman mustered the crew at the Queens Freight Yard to discuss the work and conducted a job briefing. The crew discussed using train approach warning (TAW) as its method of on-track safety.⁵ Following the job briefing, some members of the work group collected hand tools and materials to use for minor corrections of track conditions. About 9:15 a.m., the work group began walking east toward Queens Interlocking from Queens Freight Yard. The work group walked across the south passenger platform at Queens Village Station and went to track level at the east end. About 9:25 a.m., the crew began walking and inspecting main tracks 4 and 2. They continued walking east until they met with another work group near signal bridge 2 that was conducting the same type of work. The groups worked together briefly and then the second group cleared the tracks. The work group involved in this accident turned west and started inspecting tracks 1 and 3.

As they walked, the foreman was looking for items that needed repair. Three of the workers had hand tools to make those repairs. The fourth worker had a disc and an airhorn. His function was to watch for approaching trains in both directions and warn the other workers so they could

⁴ An *insulated rail joint* is constructed using insulation to prevent conduction of electrical current. These joints are used to separate track segments in order so that the signal system can function properly.

⁵ (a) According to Title 49 *Code of Federal Regulations (CFR)* Part 214, *on-track safety* refers to a state of freedom from the danger of being struck by a moving railroad train or other railroad equipment, provided by operating and safety rules that govern track occupancy by personnel, trains, and on-track equipment. (b) *Train approach warning* is a method of establishing on-track safety by warning roadway workers of the approach of trains in ample time for them to move to or remain in a place of safety.

clear the track before the train's arrival. As the group walked west between the Queens Interlocking Tower and the Queens Village Station passenger platform, an eastbound train passed on main track 4. When the rear of the eastbound train passed the work group, train 7623 approached on main track 3 traveling westbound at 78 mph. Noting the approaching train, the watchman/lookout reportedly gave audible warning using an airhorn and displayed a disc. The workers remained between the rails of track 1. During interviews, the members of the work crew said they heard the train horn as the train approached. Just before the train reached their location, the foreman walked from track 1 toward track 3 and was struck and killed by train 7623.

The striking train, 7623, was operating on a tangent track through Queens Interlocking. Of the four surviving members of the work crew, all recalled seeing the train. Two members of the work crew recalled the train being very close to their location when they became aware of it; however, they had varying accounts of the number of trains that passed them prior to the accident. All of them said that they typically clear the tracks completely to the field side of the right of way. They further stated that at times they felt it was safer for them to remain in the live track as a train passed on the adjacent track.

The locomotive engineer of the striking train stated that he sounded the train horn when he saw the roadway workers near his track. He said he saw that all the workers were to his left as he approached their location, but at the last minute one of the roadway workers stepped toward his track. Although he immediately applied the emergency brakes, he heard the impact. At that time, he called the train dispatcher and reported the accident.

1.3 Equipment

Train 7623 consisted of 12 self-propelled electric multiple unit (EMU) passenger cars with control cabs; model M7, built by Bombardier between 2002 and 2005. EMU M7s are semipermanently coupled and operate in married pairs of A and B cars with two trucks per car and a control cab at each end of the married pair. Power for the equipment is provided by a 650-volt system transmitted through a third rail to current collectors located on both sides of each truck.

The train was inspected following the accident and no mechanical exceptions were noted. The locomotive engineer reported that the train operated normally. National Transportation Safety Board (NTSB) investigators noted that the brakes, horns, and head-end lights functioned correctly; however, the event recorder did not consistently record the use of the train horn/whistle. Follow-up testing revealed that the switch that recorded the horn use was faulty. The locomotive engineer stated that he had used the train horn to warn the crew and the crew said that they heard the train horn as the train approached. Unfortunately, because of the malfunctioning event recorder, NTSB investigators were unable to determine the exact location where the train horn sounded. This also meant investigators were unable to determine the distance between the train and the struck foreman when the horn sounded, and the amount of warning time the foreman had from the time the horn sounded and the time he was struck.

1.4 Operations

The LIRR trains were authorized by signal indications in both directions on multiple tracks. The multiple main territory had numerous locations with interlocking-controlled crossovers and branch line junctions.

This accident happened within the Queens Interlocking, which was controlled by a block operator. The block operator was in a tower on the north side of the four main tracks east of the Queens Village Station passenger platform. (See figure 1 on page 2 for a representation of the tower in relation to the tracks.) Before the block operator could establish train movements and their routes, the intended train movement had to be coordinated and authorized by the train dispatcher located at the Movement Bureau at the Jamaica, New York, LIRR offices.

1.5 Personnel Information

There were five employees in the roadway work group. Although the workers had designated jobs on other days, on the day of the accident they had specific duties to conduct the Queens Village inspections and repairs. The following is a list of the employees and their assigned duties:

- Foreman – Supervised the work group (struck by train)
- Track Worker 1 – Carried a wrench to tighten bolts
- Track Worker 2 – Carried replacement bolts
- Track Worker 3 – Carried a hammer to drive loose items
- Watchman/Lookout – Carried a horn and disc with a “W” on it to warn of danger and to notify the locomotive engineer of the approaching train to sound the train whistle (horn)

1.5.1 Foreman

The foreman was hired by the LIRR on October 10, 2001, in an entry-level position. He moved up through several maintenance-of-way (MOW) positions until becoming a foreman in June 2006. On January 3, 2013, he completed training covering Title 49 *Code of Federal Regulations (CFR)* Part 214 “Railroad Workplace Safety” and Part 218 “Railroad Operating Practices.” He took the “Roadway Worker in Charge” training on September 9, 2016, and had another training class on roadway worker protection (RWP) on May 15, 2017. On the day of the accident, he supervised the work group.

1.5.2 Track Worker 1

The track worker was hired by the LIRR on June 30, 2004, in an entry-level position. He was normally assigned to be the helper on a boom truck. On March 15, 2016, he completed training covering 49 *CFR* Part 214 “Railroad Workplace Safety” and Part 218 “Railroad Operating Practices.” He took the RWP training on March 2, 2017. On the day of the accident, he carried a wrench to tighten bolts.

1.5.3 Track Worker 2

The track worker was hired by the LIRR on August 30, 2006, in an entry-level position. He was normally assigned as a boom truck driver. On March 14, 2016, he completed training covering 49 *CFR* Part 214 “Railroad Workplace Safety” and Part 218 “Railroad Operating Practices.” He took the RWP training on January 18, 2017. On the day of the accident, he carried replacement bolts.

1.5.4 Track Worker 3

The track worker was hired by the LIRR on March 26, 2008, in an entry-level position. He was normally assigned as a truck driver. On March 15, 2016, he completed training covering 49 *CFR* Part 214 “Railroad Workplace Safety” and Part 218 “Railroad Operating Practices.” He took the RWP training on March 2, 2017. On the day of the accident, he carried a hammer to drive loose items.

1.5.5 Watchman/Lookout

The track worker was hired by the LIRR on November 29, 2000, in an entry-level position. He was normally assigned as a watchman/lookout. On October 15, 2012, he completed training covering 49 *CFR* Part 214 “Railroad Workplace Safety” and Part 218 “Railroad Operating Practices.” He took the RWP training on May 5, 2017. On the day of the accident, he carried a horn and a disc with a “W” on it to warn of danger and to notify the locomotive engineer of approaching trains to sound the whistle.

1.6 Postaccident Toxicological Testing

At the request of the NTSB, muscle tissue from the foreman was tested by the Federal Aviation Administration’s Forensic Sciences Laboratory (formerly known as the Civil Aerospace Medical Institute) and the results were negative for any tested substances.⁶ Previous testing following Federal Railroad Administration (FRA) regulations suggested the presence of ethanol. This result was thought to be a contaminant as the result could not be replicated. The other workers

⁶ The FAA Forensic Sciences Laboratory has the capability to test for more than 1,300 substances including toxins, common prescription and over-the-counter medications, as well as illicit drugs. See: <http://jag.cami.jccbi.gov/toxicology/default.asp?offset=0>.

were tested following FRA guidelines. The results from the other workers tested were negative for the presence of tested substances.

2. LIRR Postaccident Actions

On June 12, 2017, 2 days after the accident, LIRR conducted a safety stand-down with the engineering department employees.⁷ All roadway workers were instructed to perform a thorough review of the applicable RWP rules that apply to engineering employees.

The following key points were stressed during the briefing and were included in a “red alert” document that was distributed on June 19, 2017 (LIRR 2017).

- Do not foul a live track without proper protection.
- Establish a predetermined place of safety (PPOS) during the required job briefing.
- Everyone must be able to clear at least 15 seconds prior to the arrival of a train or other on-track equipment at their location.
- A PPOS cannot be in a track unless working limits (main track out of service, foul time, inaccessible track) are established.

⁷ At LIRR, the engineering department is composed of signal, communications, power, structures, and facilities employees.

3. Analysis

3.1 Factors Not Contributing to this Accident

Following this accident, NTSB investigators examined the mechanical condition of the train and found the brakes and headlights worked properly. Although the train's horn was not consistently recorded by the event recorder, interviews with the surviving employees indicated they heard the train's horn. None of the employees were using their cell phones at the time of the accident. Postaccident toxicological results from the employees were negative for alcohol or tested drugs.

The NTSB concludes that none of the following were factors in this accident: (1) the mechanical condition of the train to include the train's braking system, (2) cell phone use by the employees, and (3) the use of alcohol or other tested drugs by the employees.

3.2 Roadway Worker Protection

The FRA developed regulations intended to provide protection for roadway workers. Title 49 *CFR* 214 "Railroad Workplace Safety," specifies the methods of protection when working on the tracks and the oversight requirements of the railroad. The railroad is required to provide a rules manual for the roadway workers, train the roadway workers on the rules, and monitor the employees for their compliance with the roadway worker rules.

There are several methods available to provide on-track safety to roadway workers when their duties require them to foul a track.⁸ Roadway workers can request protection from the train dispatcher and the train dispatcher will set the signals to prevent trains from entering the work area. Further, if positive train control (PTC) is in effect, the trains will be stopped before entering the designated work areas even if the locomotive engineer fails to stop the train. One of the specific requirements of PTC is to protect workers and equipment working on the track.

The regulations also include TAW for roadway workers to foul a live track for incidental inspections and minor repairs. However, TAW does not prevent trains from entering the work area (this would also exclude protection provided by PTC). The worker's protection is provided by the ability of the workers to observe and clear approaching trains 15 seconds before their arrival. The Queens Village roadway workers were using TAW on the day of the accident.

⁸ According to 49 *CFR* 214.7: (a) *On-track safety* means a state of freedom from the danger of being struck by a moving railroad train or other railroad equipment, provided by operating and safety rules that govern track occupancy by personnel, trains and on-track equipment. (b) *Fouling a track* means the placement of an individual or an item of equipment in such proximity to a track that the individual or equipment could be struck by a moving train or on-track equipment, or in any case is within 4 feet of the field side of the near running rail.

3.2.1 Train Approach Warning at Queens Village

FRA regulations and LIRR rules require that when using TAW, at least one of the workers be assigned as a watchman/lookout. This worker is responsible for warning the other workers in the work group of approaching trains. At Queens Village, the watchman/lookout had to watch for trains moving at nearly 80 mph from both directions on multiple tracks. The watchman/lookout had to give the workers enough time that they could be in the clear of the approaching train 15 seconds before the train reached their location. This meant that the time and distance to view an approaching train starts with 15 seconds and must include the additional time it takes to observe the approaching train, warn the workers, and physically clear the track.

The regulation also required that the roadway workers have a predetermined location to clear an approaching train and that the predetermined location not be on a live track.⁹ Investigators noted that the area outside the tracks at the Queens Village Interlocking had a steep slope, with heavy vegetation at the base. It would have been a difficult area for the workers to clear trains. The work group told NTSB investigators in postaccident interviews that they had agreed to clear approaching trains by moving to an active main track, despite it being prohibited by FRA regulation and LIRR rules. During the interviews, the workers explained that this had happened on several occasions in the past. In fact, security camera footage from earlier in the day of the accident shows trains passing while the workers remained in an active main track.

TAW was particularly dangerous for the crew working on the Queens Village Interlocking. Several factors, such as there being multiple tracks at the interlocking, trains operating at high speeds in both directions, and the crew having limited areas to clear trains, combined with the additional train traffic due to the Belmont Stakes, increased the risks of the work crew being struck by a train. Therefore, the NTSB concludes that the foreman failed to recognize that using TAW protection to occupy the tracks at the Queens Village Interlocking created an unacceptable risk.

3.3 Roadway Worker On-track Job Briefings

According to NTSB interviews with the surviving members of the work crew, the foreman conducted a job briefing before the crew fouled the track at the Queens Village Interlocking. The employees said that the briefing focused on the work to be performed and a discussion of the “safety rule of the day.” Although the foreman mentioned that they would use a watchman/lookout for their on-track protection, several required details were omitted. Neither the foreman nor the watchman/lookout announced where everyone needed to go as the PPOS to clear for an approaching train, the required time to reach the place of safety, and the time necessary for proper notice based on the maximum authorized train speeds. Therefore, the NTSB concludes that the on-track safety briefing held prior to the accident was incomplete because critical information such as the PPOS to be used upon receiving warning of approaching trains was not discussed, exposing the work crew to a greater risk of being struck by a train.

⁹ Title 49 *CFR* 214.329 “Train approach warning provided by watchmen/lookouts.”

3.4 Management Oversight

LIRR had an operational testing program designed to observe roadway worker crew activities when they were unaware that a supervisor was present. The program was named Situational Awareness for Efficient Railroading (SAFER). The SAFER program established the guidelines and directions for LIRR managers conducting operational testing (LIRR n.d.). The SAFER Manual for Engineering Department Employees states:

The Code of Federal Regulations mandates each railroad conduct operational tests and inspections to determine the extent of compliance by its employees with its operating rules and instructions. Our SAFER program is designed to prevent train accidents/incidents and personal injuries by improving employee operating and safety habits. In addition to the requirements mandated by the FRA, we have enhanced our system to include MOW [maintenance-of-way] employees not previously covered under the SAFER program. This program can also be used as a tool in evaluating promotional and probationary employees.

Supervisors, whose routine duties include observing the performance of employees, are required to take corrective action in the form of personal instruction upon noting an instance of employee noncompliance. Supervisors are required to take disciplinary action when an employee makes repetitive violations. The SAFER program contains a description of MOW rules or instructions to be observed and assigns a special code number for each observed rule or instruction.

NTSB investigators reviewed SAFER testing records for the LIRR Track Department from June 2016 through June 2017. During this period, 3,666 total observations were recorded with 22 cases of noncompliance reported. Four of the noncompliance entries found in the records were related specifically to RWP rules. However, none of those were related to this accident.

The following rules were part of the SAFER program and related to the accident.

- RWP25 - Timely warning of approaching trains is provided
- RWP28 - Roadway workers properly clear to predetermined place of safety
- RWP29 - Predetermined place of safety is unobstructed
- RWP30 - Work stops after warning and tracks are cleared 15 seconds before train arrives in work location

However, supervisors did not make official observations on any of these rules in the year prior to the accident.

During the postaccident interviews with NTSB investigators, the accident roadway workers' consensus was that they had adhered to the RWP requirements. Several of the roadway workers also stated that clearing on an active track was routine. One employee said that on the day of the accident, "we had an eastbound come first, so we stayed in track. All tracks were live. We stayed where we were." Other workers from the work group commented that it was sometimes

safer to remain in live tracks. Wayside video recordings of the workers on the day of the accident showed them clearing trains earlier in the shift while standing on an adjacent live track. Further, none of the roadway workers took exception to the safety briefing that did not cover the details on the TAW protection for clearing the track. Because of these admissions by the roadway workers and the routine behaviors on the day of accident, the NTSB believes that the four observations of noncompliance with RWP rules out of 3,666 total SAFER observations were not representative of the actual activities of the roadway workers. Because violations of RWP rules, such as clearing to a safe place in an active track, appeared routine and were not consistently recorded by supervisors, the NTSB concludes that the oversight by LIRR, using the SAFER program, was ineffective in ensuring compliance with RWP rules and regulations.

3.4.1 Use of TAW at Queens Village

LIRR management assigned the roadway workers to inspect the interlocking at Queens Village on the day of the accident. LIRR did not want the additional train traffic for the Belmont Stakes to be delayed due to a track issue. The traveling public demands that commuter railroad agencies focus their operations on on-time performance; however, their safety and that of the railroad's employees are equally important. Since LIRR management was aware of the increased train traffic at Queens Village Interlocking, there should have been a more deliberate assessment of the hazard of having employees occupying the tracks. As mentioned earlier, there were "multiple challenges" to clearing trains for the roadway workers when working on the tracks at Queens Village. LIRR management did not adequately assess whether TAW was an acceptable form of protection to perform the assigned work. The NTSB concludes that LIRR management did not properly assess the hazards and mitigate the risks the roadway workers were exposed to while performing their work at Queens Village when using TAW. Therefore, the NTSB recommends that the Metropolitan Transportation Authority (MTA) identify the risks associated with using TAW as a method of on-track protection and require mitigations of the risks and prohibition of its use if effective mitigations are not possible.

3.5 FRA Oversight

The FRA's Office of Railroad Safety is staffed with regional inspectors that monitor railroads' compliance with regulations. During 2017, the FRA performed 20 observations of the LIRR engineering department with six specific observations of RWP regulations. Of these, there were no recorded incidents of noncompliance. The NTSB found several incidents of noncompliance during its investigation, which encompassed 11 months of review, and evidence that such violations were commonplace, yet the FRA inspections did not find similar noncompliance with RWP rules and regulations. The NTSB concludes that the FRA's inspection program was ineffective in finding LIRR's noncompliance with RWP regulations. Therefore, the NTSB recommends that the FRA revise its oversight inspection process to focus on roadway worker activities, especially when roadway workers are using TAW for protection.

3.5.1 TAW and the FRA

Roadway workers use TAW to foul the tracks without stopping trains for limited types of track work. When using TAW, the FRA requires that roadway workers be able to clear the train at least 15 seconds before its arrival at their location.

Regulations for RWP have been in effect since 1997.¹⁰ Following the implementation of the regulations, a committee of representatives from railroad labor, management, and federal regulators was formed. The committee, Fatality Analysis of Maintenance of Way Employees and Signalmen (FAMES), collects and evaluates data on MOW accidents and employee fatalities.

On June 15, 2018, the FAMES committee published a bulletin that specifically addressed TAW fatalities. The report showed that since the implementation of the regulation in 1997, 16 roadway workers had been killed using TAW as protection. Of the 16 fatalities, 5 were the roadway workers assigned as the watchman/lookout who were supposed to watch for approaching trains and to warn their coworkers. Further, as in this accident at Queens Village, 12 of the 13 accidents occurred when TAW was used in locations with multiple tracks.¹¹

On September 18, 2019, in response to an NTSB inquiry, the FRA provided data that showed that 66 roadway workers have been fatally injured in 61 accidents since the RWP rule was implemented in 1997. Fifteen of those accidents occurred while the roadway workers were using TAW, and in three of those occasions, the roadway worker was struck by a train on the adjacent track.

The NTSB investigated an accident at Edgemont, South Dakota, on January 17, 2017 (NTSB 2018). In that accident, two roadway workers were killed while using TAW as protections. As a result, the NTSB issued *Watchman/Lookout: Your coworkers depend on you* (NTSB 2017). The safety alert was distributed to the Class I railroads, the Brotherhood of Railroad Signalmen, and the Brotherhood of Maintenance of Way Employees.¹² The alert was meant (1) to highlight the hazards involved in the use of TAW as a form of on-track safety for roadway work groups and (2) to heighten awareness of these hazards by the roadway workers who depend on this form of on-track safety.

The roadway workers in both the Edgemont and Queens Village investigations failed to comply with specific TAW requirements. The job briefings were incomplete and the roadway workers cleared to active tracks, contrary to FRA regulations. The NTSB has found instances of noncompliance in multiple accident investigations where specific details of the RWP regulations were not performed or performed poorly (NTSB 2018, 2017b, 2014). However, the failures were not always the same. Finding and correcting noncompliance with the TAW regulations has proven to be difficult. The NTSB has repeatedly recognized during accident investigations that TAW is not an effective way to provide safety for railroad employees. Of all the methods of RWP to protect work groups, it is the only one that requires the roadway worker to clear from the path of approaching trains. The other methods, such as exclusive track occupancy, keep trains away from

¹⁰ Title 49 *CFR* Part 214, “Railroad Workplace Safety.”

¹¹ Some of these accidents involved multiple fatalities.

¹² The Brotherhood of Maintenance of Way Employees spells the word “Employee” in its name with one e. Therefore, we are using this spelling in this report.

the roadway workers and use the protections of PTC. The NTSB concludes that the TAW regulations do not ensure protection for roadway workers to inspect and work on tracks where trains are allowed to continue to operate. Therefore, the NTSB recommends that FRA define when the risks associated with using TAW are unacceptable and revise 49 *CFR* 214.329 to prohibit the use of TAW when the defined risks are unacceptable.

3.6 Worker Fatigue

The NTSB examined the work/rest cycle for the MOW track workers. Through a labor/management agreement, track workers were able to work overtime shifts based on their skill and seniority, but without other considerations such as their fatigue. The watchman/lookout and the foreman had accepted continuous on-duty shifts, which likely disrupted their sleep patterns for 2 nights prior to the accident.

As shown in figures 3 and 4, both the watchman/lookout and the foreman worked overnight overtime shifts starting on Thursday. Their sleeping, eating, and commuting hours are shown, where known. The information was consolidated from the LIRR timecards and interviews with the watchman/lookout.

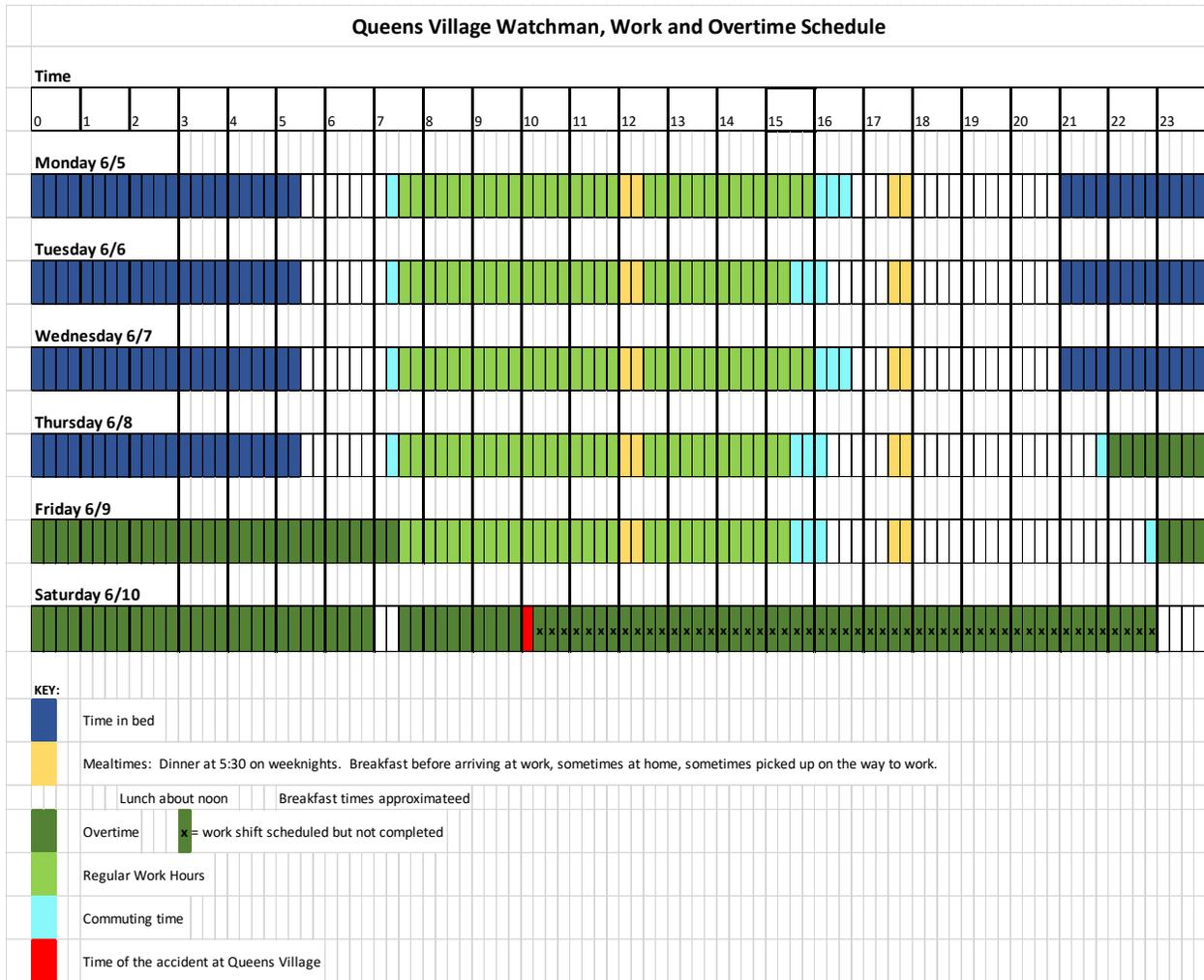


Figure 3. Queens Village watchman/lookout, work and overtime schedule.

The watchman/lookout worked and commuted for about 38 out of 50 hours leading up to the time of the accident. This schedule did not allow him to sleep as usual; specifically, for the 2 nights prior to the accident, his opportunities for sleep were reduced in duration and shifted to early evening periods. This change in schedule is an acute disruption to his circadian rhythm, which likely caused him to be fatigued on the day of the accident.¹³

¹³ A *circadian rhythm* is a natural, internal process that regulates the sleep-wake cycle and repeats roughly every 24 hours.

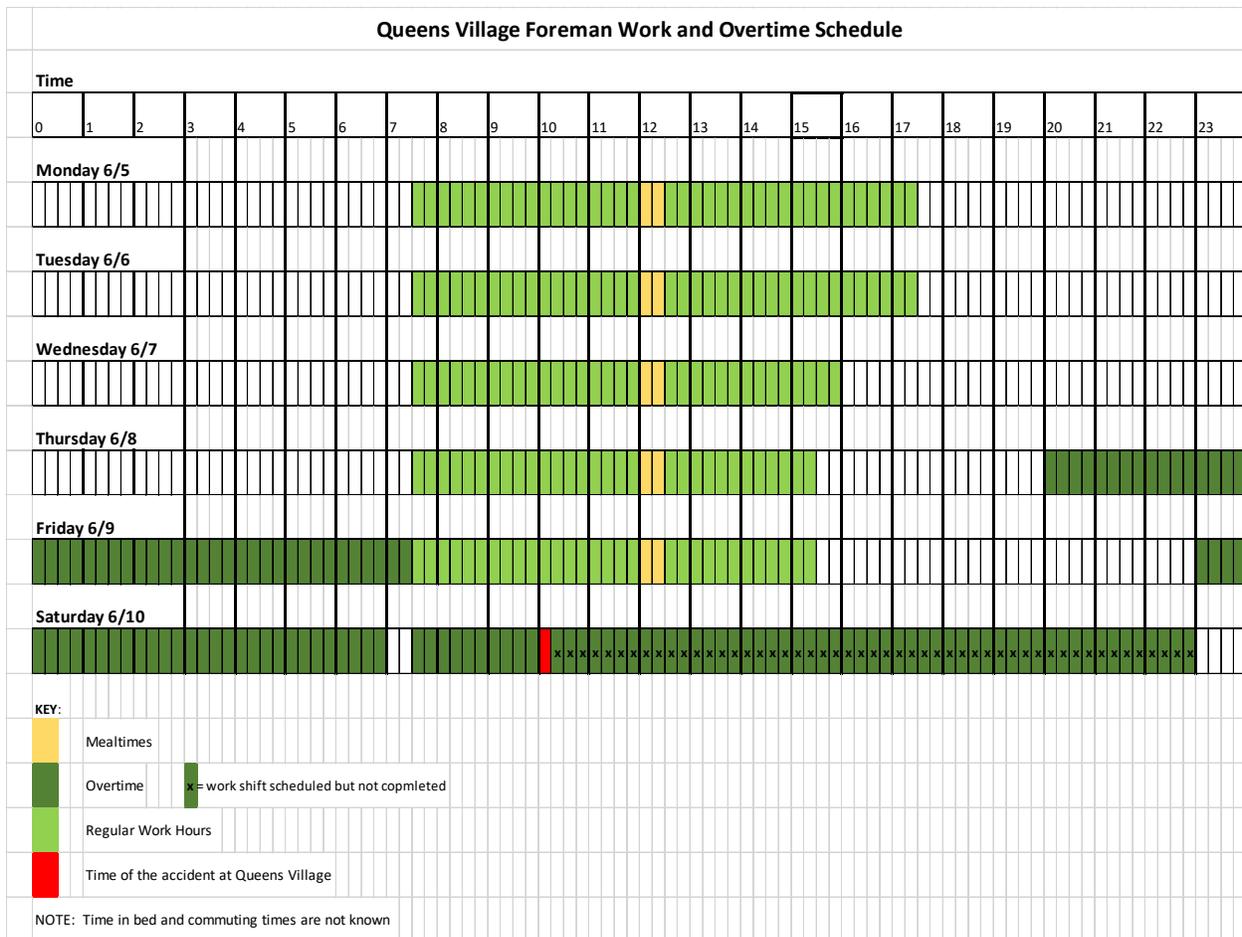


Figure 4. Queens Village foreman, work and overtime schedule.

The foreman’s work schedule was similar. Unfortunately, because of the foreman’s death, NTSB investigators could not determine his routine in the days prior to the accident; however, he was on duty for 38 of the 50 hours prior to the accident. Like the watchman/lookout, this schedule did not allow adequate restorative sleep for the 2 nights prior to the accident.

3.6.1 Fatigued State

Based on the foreman’s and the watchman/lookout’s work schedules for 2 days prior to the accident, they were unable to receive restorative sleep for 2 consecutive nights prior to the day of the accident. The FRA analyzed these work schedules and found that both employees were in a fatigued state prior to the accident. Fatigue can cause workers to take shortcuts (workload shedding), delay reactions, and make poor decisions. The NTSB has noted the effect of fatigue in previous accident investigations, such as a collision of two Union Pacific Railroad freight trains in Hoxie, Arkansas, on August 17, 2014 (NTSB 2016). In that report, NTSB cited a 2014 FRA study that examined the effects of fatigue on human performance and noted that fatigue decreases a person’s alertness and ability to work safely. Therefore, the NTSB concludes that the watchman/lookout and the foreman were likely fatigued because their overtime shifts did not allow for adequate periods of restorative sleep during the 2 nights before the accident.

The NTSB has a long history of making recommendations in all modes of transportation to reduce the likelihood of fatigue-related accidents. In the railroad industry, the scope of the NTSB's recommendations have included requiring railroads to use scientifically based principles when assigning work schedules; requiring railroads to design work schedules to minimize irregular and unpredictable work-rest cycles; establishing requirements that limit train crewmember limbo time; developing a standard medical form that includes questions about sleep problems; requiring serious and potentially impairing medical conditions to be reported to and evaluated by the carrier; and requiring railroads to develop fatigue awareness training. In the past, the focus of these recommendations has been on operating crews, however, as shown in this section, employees that maintain the track are equally subject to the effects of fatigue.

The FRA encourages the use of certified biomathematical models, such as the Fatigue Audit InterDyne Model and the Fatigue Avoidance Scheduling Tool (FAST) by railroads to help them develop work schedules for safety-sensitive employees that align with healthy work-rest scheduling practices; however, these safety measures do not apply to roadway workers.¹⁴ The work schedules developed through biomathematical models avoid many pitfalls causing worker fatigue that arise from excessively long work hours, highly variable work shift times that disrupt human circadian rhythms, and infringement on sleep opportunity times.

Following this accident, the FRA conducted a FAST, one of its two certified mathematical models, for the foreman and watchman/lookout involved in this accident. The finding of FRA's FAST analysis indicated that the foreman and the watchman/lookout were below acceptable levels of effectiveness on the day before the accident, based on their work schedules. This aligns with previous NTSB recommendations that railroads should use biomathematical models and other scientifically based approaches to develop work-rest schedules that avoid worker fatigue (NTSB 2016, NTSB 2015, and NTSB 2012).¹⁵ The NTSB concludes that had LIRR used biomathematical models of fatigue avoidance to guide its development and approval of work schedules for roadway workers, the likely fatigue of the foreman and watchman/lookout would have been avoided and their overtime work requests for the day of the accident would have been denied.

In this accident, NTSB investigators found that the protocol for determining overtime assignments for roadway workers was contained in the labor agreement between LIRR and the labor union, the International Association of Sheet Metal, Air, Rail and Transportation Workers (SMART).¹⁶ The labor agreement outlined rules for work assignments based on the specialty of work involved and the seniority of workers available. The rules offered overtime to employees who had been with the LIRR the longest, but did not consider the worker's continuous on-duty times and, therefore, their risk of fatigue caused by the overtime schedules.

¹⁴ Title 49 *CFR* 228.407.

¹⁵ R-12-17 issued to the FRA, currently classified "Open—Acceptable Response"; R-15-18 issued to the Federal Transit Administration, currently classified "Open—Acceptable Response"; R-16-43 issued to the FRA, currently classified "Open—Unacceptable Response"; and R-16-46 issued to all of the Class I railroads, current overall classification of "Open—Await Response."

¹⁶ Agreement entered into by and between the Long Island Rail Road Company and Maintenance of Way Employees Represented by SMART Local 29, dated May 31, 2016. (See NTSB docket for complete agreement.)

The allowed overtime hours during this short period of time for the foreman and lookout in this accident is alarming, especially since the problem of excessive overtime at LIRR has been noted elsewhere. In a May 1, 2019, article (Hicks and Brown 2019), one LIRR employee reportedly claimed over \$300,000 in overtime in 2018. Another LIRR track worker reportedly worked 4,157 extra hours, averaging 22.4 hours of work per day in a standard 5-day work week. In this accident, the foreman and lookout each worked multiple overtime shifts of continuous hours that limited their opportunities for restorative sleep for consecutive nights prior to the accident.

Therefore, the NTSB concludes that the LIRR and SMART allowed workers to schedule overtime hours without consideration of fatigue, which exposed employees and the public to unnecessary risk. Therefore, the NTSB recommends that MTA work with SMART to develop and implement a work scheduling program for roadway workers using a validated biomathematical model of fatigue avoidance to ensure that roadway workers at risk of being fatigued are not eligible for overtime. Because this issue should be addressed from both the management and union perspective, the NTSB also recommends that SMART work with MTA management to develop and implement a work scheduling program for roadway workers using a validated biomathematical model of fatigue avoidance to ensure that roadway workers at risk of being fatigued are not eligible for overtime.

Currently, the FRA does not classify roadway workers as personnel in covered service positions, which applies to certain employees involved with the movement of a train, including operators, dispatchers, and signal employees.¹⁷ Consequently, there are limited or no safety controls from the FRA or railroads beyond union agreements and local work practices that limit roadway workers' maximum work hours and ensure adequate opportunities for needed sleep. Specifically, while covered service employees are subject to hours of service regulations to limit their on-duty times, roadway workers are not protected by these regulations. The NTSB concludes that without an FRA requirement of hours of service regulations, roadway workers are at risk for fatigue-related accidents involving movements of trains. The NTSB further concludes that roadway workers are at risk from fatigue-related accidents when management-labor contracts do not include work hour limits that address the risk of fatigue. Because roadway workers' duties often affect the movement of a train and could possibly create unnecessary safety risks for employees and the traveling public, the NTSB recommends that the FRA promulgate scientifically based hours of service requirements for roadway workers.

¹⁷ Title 49 *CFR* 228.5.

4. Urgent Recommendations

On September 15, 2017, NTSB investigators interviewed LIRR engineering department employees, including two track foremen who regularly worked in the Queens Interlocking and were qualified to serve as roadway workers-in-charge. The foremen were asked specific questions that related to a “red alert,” (mentioned in the section on LIRR Postaccident Actions) that was issued on June 19, 2017, by the LIRR following the Queens Village accident. The alert gave instructions and explained that when using TAW protection, work groups should have a predetermined safe place other than on a live track. One foreman said it was okay to clear on a live track when trains were on an adjacent track, and the other foreman said you can never clear on a live track. This countered the fact that LIRR held safety briefings following the accident with roadway workers and gave specific guidelines not to clear on live tracks.

The NTSB was concerned that LIRR’s safety messages were not reaching the employees and, therefore, not changing unsafe practices. Since the MTA oversees LIRR, the NTSB believed it would be effective to have the MTA audit and correct deficiencies, if found, in the TAW protection used by the roadway workers at LIRR. Therefore, on February 13, 2018, the NTSB issued urgent safety recommendations R-18-6 and R-18-7 to MTA (NTSB 2018b):

Audit Long Island Rail Road’s use of train approach warning as a method of worker protection for compliance with Long Island Rail Road rules and federal regulations. (R-18-6) (**Urgent**)

Following the completion of the audit, implement actions to correct any identified deficiencies. (R-18-7) (**Urgent**)

In an April 2018 response to this recommendation, MTA said it would conduct the audit with technical assistance from the FRA.¹⁸ In a November 8, 2019, letter, the NTSB noted that the MTA completed the recommended audit using video data from the forward-facing cameras on operating locomotives and trailing cab cars to identify roadway workers on or near the tracks. As part of its continuing oversight of its operations, this technique has been incorporated into MTA’s continuing oversight of its operations to identify work crews that require retraining, as well as for expanding and re-enforcing education regarding TAW and RWP. Following any identified break from TAW procedures, MTA acted to re-educate its workforce about the importance of RWP and the appropriate use of TAW. These actions satisfied Safety Recommendations R-18-6 and -7, which were classified “Closed—Acceptable Action.”

¹⁸ Letter from MTA to the NTSB, April 18, 2018.

5. Conclusions

5.1 Findings

1. None of the following were factors in this accident: (1) the mechanical condition of the train to include the train's braking system, (2) cell phone use by the employees, and (3) the use of alcohol or other tested drugs by the employees.
2. The foreman failed to recognize that using train approach warning protection to occupy the tracks at the Queens Village Interlocking created an unacceptable risk.
3. The on-track safety briefing held prior to the accident was incomplete because critical information such as the predetermined place of safety to be used upon receiving warning of approaching trains was not discussed, exposing the work crew to a greater risk of being struck by a train.
4. Because violations of roadway worker protection rules, such as clearing to a safe place in an active track, appeared routine and were not consistently recorded by supervisors, the oversight by Long Island Rail Road, using the Situational Awareness for Efficient Railroading program, was ineffective in ensuring compliance with roadway worker protection rules and regulations.
5. Long Island Rail Road management did not properly assess the hazards and mitigate the risks the roadway workers were exposed to while performing their work at Queens Village when using train approach warning.
6. The Federal Railroad Administration's inspection program was ineffective in finding Long Island Rail Road's noncompliance with roadway worker protection regulations.
7. Train approach warning regulations do not provide the necessary protection for roadway workers to inspect and work on tracks where trains are allowed to continue to operate.
8. The watchman/lookout and the foreman were likely fatigued because their overtime shifts did not allow for adequate periods of restorative sleep during the 2 nights before the accident.
9. Had Long Island Rail Road used biomathematical models of fatigue avoidance to guide its development and approval of work schedules for roadway workers, the likely fatigue of the foreman and the watchman/lookout would have been avoided and their overtime work requests for the day of the accident would have been denied.

10. The Long Island Rail Road and the International Association of Sheet Metal, Air, Rail and Transportation Workers allowed workers to schedule overtime hours without consideration of fatigue, which exposed employees and the public to unnecessary risk.
11. Without a Federal Railroad Administration requirement of hours of service regulations, roadway workers are at risk for fatigue-related accidents involving movements of trains.
12. Roadway workers are at risk from fatigue-related accidents when management-labor contracts do not include work hour limits that address the risk of fatigue.

5.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was Long Island Rail Road's decision to use train approach warning to protect the roadway workers on active tracks. Contributing to the accident was Long Island Rail Road's and the International Association of Sheet Metal, Air, Rail and Transportation Workers' allowance of overtime work schedules without properly considering and mitigating workers' risk of fatigue.

6. Recommendations

6.1 New Recommendations

As a result of the investigation, the National Transportation Safety Board makes the following new safety recommendations.

To the Federal Railroad Administration:

Revise your oversight inspection process to focus on roadway worker activities, especially when roadway workers are using train approach warning for protection. (R-20-5)

Define when the risks associated with using train approach warning are unacceptable and revise Title 49 *Code of Federal Regulations* 214.329 to prohibit the use of train approach warning when the defined risks are unacceptable. (R-20-6)

Promulgate scientifically based hours of service requirements for roadway workers. (R-20-7)

To the Metropolitan Transportation Authority:

Identify the risks associated with using train approach warning as a method of on-track protection, and require mitigations of the risks and prohibition of its use if effective mitigations are not possible. (R-20-8)

Work with the International Association of Sheet Metal, Air, Rail and Transportation Workers to develop and implement a work scheduling program for roadway workers using a validated biomathematical model of fatigue avoidance to ensure that roadway workers at risk of being fatigued are not eligible for overtime. (R-20-9)

To the International Association of Sheet Metal, Air, Rail and Transportation Workers:

Work with Metropolitan Transportation Authority management to develop and implement a work scheduling program for roadway workers using a validated biomathematical model of fatigue avoidance to ensure that roadway workers at risk of being fatigued are not eligible for overtime. (R-20-10)

6.2 Previously Issued Recommendations

On February 13, 2018, the National Transportation Safety Board issued the following safety recommendations:

To the Metropolitan Transportation Authority:

Audit Long Island Rail Road's use of train approach warning as a method of worker protection for compliance with Long Island Rail Road rules and federal regulations. (R-18-6) (**Urgent**)

This recommendation was previously classified "Closed—Acceptable Action" on November 8, 2019.

Following the completion of the audit, implement actions to correct any identified deficiencies. (R-18-7) (**Urgent**)

This recommendation was previously classified "Closed—Acceptable Action" on November 8, 2019.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

ROBERT L. SUMWALT, III
Chairman

JENNIFER HOMENDY
Member

BRUCE LANDSBERG
Vice Chairman

MICHAEL GRAHAM
Member

THOMAS B. CHAPMAN
Member

Date: April 29, 2020

Appendix

The National Transportation Safety Board (NTSB) was notified on June 10, 2017, that a Long Island Rail Road train had struck and killed a maintenance-of-way worker near the Queens Village Station in Queens, a borough of New York City. The NTSB launched an investigator-in-charge, and three team members to investigate the accident.

Parties to the investigation included the Federal Railroad Administration; Long Island Rail Road; the Brotherhood of Locomotive Engineers and Trainmen; the International Association of Sheet Metal, Air, Rail and Transportation Workers; the Brotherhood of Maintenance of Way Employees; and the New York State Department of Labor.

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